OneCommand™ NIC Teaming and VLAN Manager

Version 2.5

for Windows Server 2003

Windows Server 2008

Windows Server 2008 R2

User Manual

P006604-01A Rev. A

Emulex Connects™
Servers, Storage and People

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Overview

The Emulex OneCommand™ Network Interface Card (NIC) Teaming and Virtual Local Area Network (VLAN) manager provides the ability to team two or more NIC/vNIC ports. It also allows you to add one or more VLANs over a team or over a NIC/vNIC.

A VLAN is a network of computers that behave as if they are connected to the same wire even though they may actually be physically located on different segments of a Local Area Network (LAN). VLANs are configured through software rather than hardware, which make them extremely flexible. One advantage of a VLAN is that when a computer is physically moved to another location, it can stay on the same VLAN without any hardware reconfiguration.

To increase throughput and bandwidth, and to increase link availability, you can configure multiple network interfaces on one or more ethernet ports to appear to the network as a single interface. This is referred to as Network Interface Card (NIC) teaming, or multi-link trunking.

Supported Features

The Windows NIC Teaming and VLAN Manager supports the following features:

- vNIC teaming
- Switch-controlled teaming (Link Aggregation Control Protocol [LACP])
- Switch independent teaming types
    - Failover (FO)
    - Smart load balancing (SLB)
        - TX/RX load balancing
        - TCP/IP load balancing
        - Non-TCP/IP TX load balancing
        - Media Access Control (MAC) address load balancing
        - Dynamic link aggregation
- Auto Failback
- Hashing
    - Perceived Port Load
    - Destination IP hashing
    - Destination MAC hashing (DAMAC)

Supported Operating Systems

The Windows NIC Teaming and VLAN Manager support the following Windows Server 2003 operating systems:

- Windows Server 2003 x86
- Windows Server 2003 x86 R2
- Windows Server 2003 x64
- Windows Server 2003 x64 R2

Note: If you are running Windows Server 2003 Service Pack 2 and have NICs with TOE capability, you must disable TOE/RSS/TCPA by applying Microsoft's KB948496.

The Windows NIC Teaming and VLAN Manager supports the following Windows Server 2008 operating systems:

- Windows Server 2008 x86 SP2
- Windows Server 2008 x64 SP2
- Windows Server 2008 x64 R2
- Windows Server 2008 x64 R2 SP1
- Windows Server 2008 x64 R2 with Hyper-V

  Note: For Windows Server 2008 x64 R2 and Windows Server 2008 x64 R2 with Hyper-V, TCP/IP offload engine (TOE) technology is enabled.

- Windows Server 2008 x64 R2 SP1 with Hyper V

Why Teaming?

NIC teaming allows you to group multiple NICs as a single virtual device. Depending on the teaming type, one or more interfaces can be active. When you combine multiple NICs this way, the group is a team. NIC teaming has several advantages.

- Increased bandwidth - Two or more network interfaces are combined to share the load, thus increasing bandwidth.
- Load balancing - Link aggregation enables distribution of processing and communication across multiple links.
- Higher link availability - Prevents a single link failure from disturbing traffic flow.

Teaming Types

There are different types of teaming:

- Switch independent
  - Failover - If configured for fault tolerance, the system provides only failover.
  - Smart load balancing - If configured for load balancing, failover is included.
- Switch dependent
  - Link Aggregation Control Protocol (LACP)

Terminology

- Team - A group of unbound adapters working together and presented as a single adapter to applications.
- VLAN - A Virtual LAN allows computers or virtual machines (hypervisor guests) to act as if they are connected by a private, directly connected network. You can assign VLANs to teams or individual adapters.
- VLAN Bound adapter - A single adapter to which you assigned VLANs. This adapter cannot be part of a team. These are also called VLAN adapters.
- Available adapter - An adapter that is not a member of a team and has no assigned VLANs. This adapter is also called a free adapter.

Failover (FO)

A failover team consists of two members; a primary and a secondary member. Only one member is active at a time. When a team is created, the primary member is active and the secondary member is passive, but only one member is active at a time. When the primary team member disconnects (due to link down, link disabled or any other reason) the failover mechanism selects the secondary team member (which is in a link up state) and traffic continues.

When a previously failed primary team member reports a link up state, failback to the primary member occurs only if the team was created with Auto Failback enabled.

For teams created with AutoFailback disabled, traffic will continue on the secondary adapter. By default all the team members use the same MAC address, the MAC address of the primary team member.

Load Balancing

Smart Load Balancing [(SLB) Team Load Balancing]

Team load balancing provide both load balancing and fault tolerance. Team load balancing works with any Ethernet switch and does not require any switch configuration. The team advertises multiple MAC addresses and one or more IP addresses. The virtual team adapter selects the team MAC address from the list of load balancing members. When the server receives an address resolution protocol (ARP) request, the software-networking stack always sends an ARP reply with the team MAC address. To begin the load balancing process, the OneCommand NIC Teaming and VLAN Manager modifies this ARP reply by changing the source MAC address to match one of the physical adapters.

Load balancing enables both transmit and receive load balancing based on load balancing function to maintain in-order delivery of frames.

Transmit load balancing is achieved by creating a hashing table using the hashing algorithm based on load distribution type. When the virtual teaming adapter selects a physical adapter (or port) to carry all the frames to the destination, the unique MAC address of the physical adapter is included in the frame, and not the team MAC address. This is required to comply with the IEEE 802.3 standard. If two adapters transmit using the same MAC address, a duplicate MAC address situation would occur that the switch could not handle.

Receive load balancing is achieved through an intermediate driver by sending gratuitous ARPs on a client by client basis using the unicast address of each client as the destination address of the ARP request (also known as a directed ARP). This is client load balancing and not traffic load balancing. When the intermediate driver detects a significant load imbalance between the physical adapters in an LB team, it generates gratuitous ARPs in an effort to redistribute incoming frames. The intermediate driver does not answer ARP Requests; only the software protocol stack provides the required ARP reply. It is important to understand that receive load balancing is a function of the number of clients that are connecting to the server via the team interface.

Receive load balancing attempts to load balance incoming traffic for client machines across physical ports in the team. It uses a modified gratuitous ARP to advertise a different MAC address for the team IP address in the sender physical and protocol address. This gratuitous ARPs is unicast with the MAC and IP address of a client machine in the target physical and protocol address respectively. This causes the target client to update its ARP cache with a new MAC address map to the team IP address. This has the potential to direct the received traffic to a different adapter than learned in from the transmission. Gratuitous ARPs are not broadcast because this would cause all clients to send their traffic to the same port. As a result, the benefits achieved through client load balancing would be eliminated, and could cause out of order frame delivery. This receive load balancing scheme works as long as all clients and the teamed server are on the same subnet or broadcast domain.

When the clients and the server are on different subnets, and incoming traffic has to traverse a router, the received traffic destined for the server is not load balanced. The physical adapter that the intermediate driver has selected to carry the IP flow carries all of the traffic. When the router needs to send a frame to the team IP address, it broadcasts an ARP request (if not in the ARP cache). The server software stack generates an ARP reply with the team MAC address, but the intermediate driver modifies the ARP reply and sends it over a particular physical adapter, establishing the flow for that session over the particular physical adapter. The reason is that ARP is not a routable protocol. It does not have an IP header and therefore is not sent to the router or default gateway. ARP is only a local subnet protocol. In addition, since the gratuitous ARP is not a broadcast packet, the router does not process it and does not update its own ARP cache.

The only way that the router would process an ARP intended for another network device is if the router has proxy ARP enabled and the host has no default gateway. This is very rare and not recommended for most applications.

Transmitted traffic through a router is load balanced and is based on the source and destination IP address and TCP/UDP port number. Since routers do not alter the source and destination IP address, the load balancing algorithm works as intended.

Switch-Controlled Teaming (Link Aggregation Control Protocol [LACP])

IEEE 802.3ad LACP is similar to link aggregation static mode except that it uses the LACP to negotiate the ports that make up the team. The LACP must be enabled at both the server and the switch for the team to operate. If LACP is not available at both ends of the link, 802.3ad provides a manual aggregation that only requires both ends of the link to be in a link up state.

Because manual aggregation provides for the activation of a member link without performing the LACP message exchanges, it is not as reliable and robust as an LACP negotiated link. LACP automatically determines which member links can be aggregated and then aggregates them. It provides for the controlled addition and removal of physical links for the link aggregation so that no frames are lost or duplicated. The removal of aggregate link members is provided by the marker protocol that can be optionally enabled for LACP-enabled aggregate links.

The link aggregation group advertises a single MAC address for all the ports in the team. The MAC address of the team/aggregator can be the MAC addresses of one of the NICs in the group. The LACP and marker protocols use a multicast destination address.

The link aggregation control function determines which links may be aggregated. It then binds the ports to an aggregator function in the system and monitors conditions to determine if a change in the aggregation group is required. Link aggregation combines the individual capacity of multiple links to form a high performance virtual link. The failure or replacement of a link in an LACP trunk does not cause loss of connectivity. The traffic fails over to the remaining links in the trunk.

Installing and Uninstalling the OneCommand NIC Teaming Driver and NIC Teaming and VLAN Manager

There are two ways to install the OneCommand NIC Teaming driver and the Nic Teaming and VLAN Manager:

- Attended installation using the GUI.
- Unattended installation using the command line.

Attended Installation

Prerequisites

Microsoft .NET Framework 3.5 must be installed before you can install the OneCommand NIC Teaming driver and NIC Teaming and VLAN Manager. If a Microsoft .NET Framework version higher than 3.5 is already installed, Microsoft .NET Framework 3.5 must be installed as well.

Procedure

To perform an attended installation:

1. From the Emulex website, download the elxdrvr-nic-teaming-<version>.exe to your system. The installer is an executable file that self-extracts and copies the following software onto your system:
    - NIC Teaming driver
    - NIC Teaming and VLAN Manager
    - NIC Teaming and VLAN Manager utilities
2. Navigate to the system directory to which you downloaded the file and double click the elxdrvr-nic-teaming-<version>.exe file.

Unattended Installation

An unattended driver installation (a quiet or silent installation) requires no user input. This is useful for performing an installation remotely from a command script, or when you want to make sure a custom configuration is not changed by a user during installation.

Prerequisites

Microsoft .NET Framework 3.5 must be installed before you can install the OneCommand NIC Teaming driver and NIC Teaming and VLAN Manager. If a Microsoft .NET Framework version higher than 3.5 is already installed, Microsoft .NET Framework 3.5 must be installed as well.

Procedure

To perform an unattended installation:

1. From the Emulex web site, download the elxdrvr-nic-teaming-<version>.exe file to your system.

   The kit is activated with the optional switch /q or /q2. The /q switch displays progress reports.

   The /q2 switch does not display progress report.
2. Run the driver kit installer with the optional switch.

For example, use the following command:

```
elxdrvr-nic-teaming-<version>.exe /q2
```

Updating the OneCommand NIC Teaming Driver and NIC Teaming and VLAN Manager

WARNING: Use the new Emulex-provided kit to upgrade the NIC Teaming and VLAN Manager. Do not use a previous version of the driver utilities to upgrade the OneCommand NIC Teaming driver and NIC Teaming and VLAN Manager. If you do, unpredictable results will occur.

Note: Do not update the NIC Teaming driver and NIC Teaming and VLAN Manager while I/O traffic is running. If you do, unpredictable results will occur.

To update the NIC Teaming driver and NIC Teaming and VLAN Manager and preserve the existing configuration (including the IP address):

1. From the Emulex website, download the latest file named elxdrvr-nic-teaming-<version>.exe to your system.
2. Double click the elxdrvr-nic-teaming-<version>.exe.

Uninstalling the OneCommand NIC Teaming Driver and NIC Teaming and VLAN Manager

To uninstall the NIC Teaming package:

1. Use the Add/Remove Programs Control Panel (on Windows Server 2003) or the Programs and Features Control Panel (on all Windows Server 2008 operating systems).

WARNING: Use the new Emulex-provided kit to uninstall the driver. Do not use a previous version of the driver utilities to uninstall the OneCommand NIC Teaming driver and NIC Teaming and VLAN Manager. If you do, unpredictable results will occur.

Caution: Uninstalling the NIC Teaming package will remove all existing teams and VLANs.

- For Windows Server 2003 systems, select **Start>Control Panel>Add/Remove Programs**.
- For Windows Server 2008 & Windows Server 2008 R2, select **Start>Control Panel>Programs>Uninstall a Program**.

Starting the OneCommand NIC Teaming and VLAN Manager

To start the OneCommand NIC Teaming and VLAN Manager:

1. From your desktop start menu, click the **OC NIC Teaming Manager** to start the application.

Using the OneCommand NIC Teaming and VLAN Manager

Note: For Windows Server 2008 x64 R2 and Windows Server 2008 x64 R2 with Hyper-V, TCP/IP offload engine (TOE) technology is enabled.

Note: For Windows Server 2003 operating systems, you must disable TOE/RSS/TCPAA by applying Microsoft's KB948496.

Creating, Configuring and Removing Teams

A team of adapters functions as a single virtual network interface and appears the same as a non-teamed adapter to other network devices. A protocol address such as an IP address is usually assigned to the physical adapter. However, when the OneCommand NIC Teaming and VLAN Manager is installed, the protocol address is assigned to the team adapter and not to the physical adapters that make up the team.

Note: The NIC Teaming and VLAN Manager supports multi-vendor teams. Each team or VLAN in a multi-vendor environment must include at least one Emulex adapter.

- Emulex has tested the NIC Teaming and VLAN Manager with Intel (x520) and Broadcom (Netextreme II) adapters.
- Emulex has not tested and does not support the insertion of Chelsio adapters in teams and VLANs.

Creating and Configuring a Team

Caution: Creating a team may take several minutes. Prematurely cancelling this operation may result in the partial creation or deletion of a team or VLAN. Such an act may also lead to future teaming issues or even system instability.

To create and configure a team:

1. From the Start menu click **All Programs>Emulex>OneCommand Teaming and VLAN Manager** to start the application. The OneCommand NIC Teaming and VLAN Manager dialog box is displayed.

.

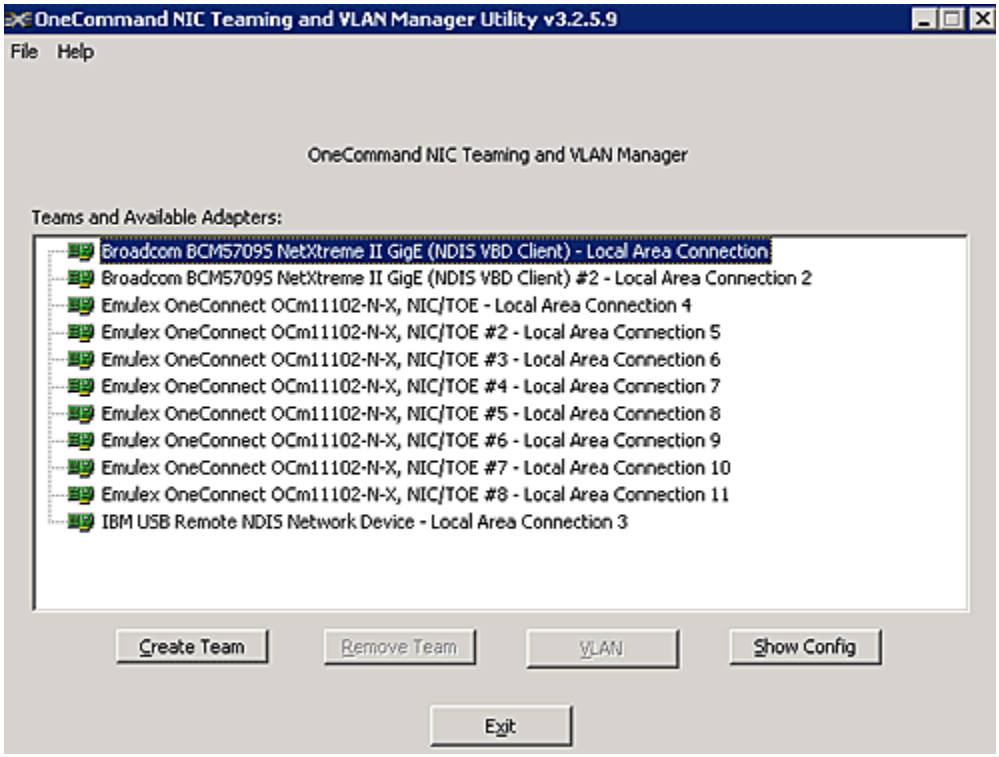

OneCommand NIC Teaming and VLAN Manager Utility v3.2.5.9
File Help
OneCommand NIC Teaming and VLAN Manager
Teams and Available Adapters:
Broadcom BCM57095 NetXtreme II GigE (NDIS VBD Client) - Local Area Connection
Broadcom BCM57095 NetXtreme II GigE (NDIS VBD Client) #2 - Local Area Connection 2
Emulex OneConnect OCm11102-N-X, NIC/TOE - Local Area Connection 4
Emulex OneConnect OCm11102-N-X, NIC/TOE #2 - Local Area Connection 5
Emulex OneConnect OCm11102-N-X, NIC/TOE #3 - Local Area Connection 6
Emulex OneConnect OCm11102-N-X, NIC/TOE #4 - Local Area Connection 7
Emulex OneConnect OCm11102-N-X, NIC/TOE #5 - Local Area Connection 8
Emulex OneConnect OCm11102-N-X, NIC/TOE #6 - Local Area Connection 9
Emulex OneConnect OCm11102-N-X, NIC/TOE #7 - Local Area Connection 10
Emulex OneConnect OCm11102-N-X, NIC/TOE #8 - Local Area Connection 11
IBM USB Remote NDIS Network Device - Local Area Connection 3
Create Team
Remove Team
VLAN
Show Config
Exit

Figure 1: OneCommand NIC Teaming and VLAN Manager dialog box

2. Click **Create Team**.

The OneCommand NIC Teaming and VLAN Manager - Create Team dialog box is displayed.

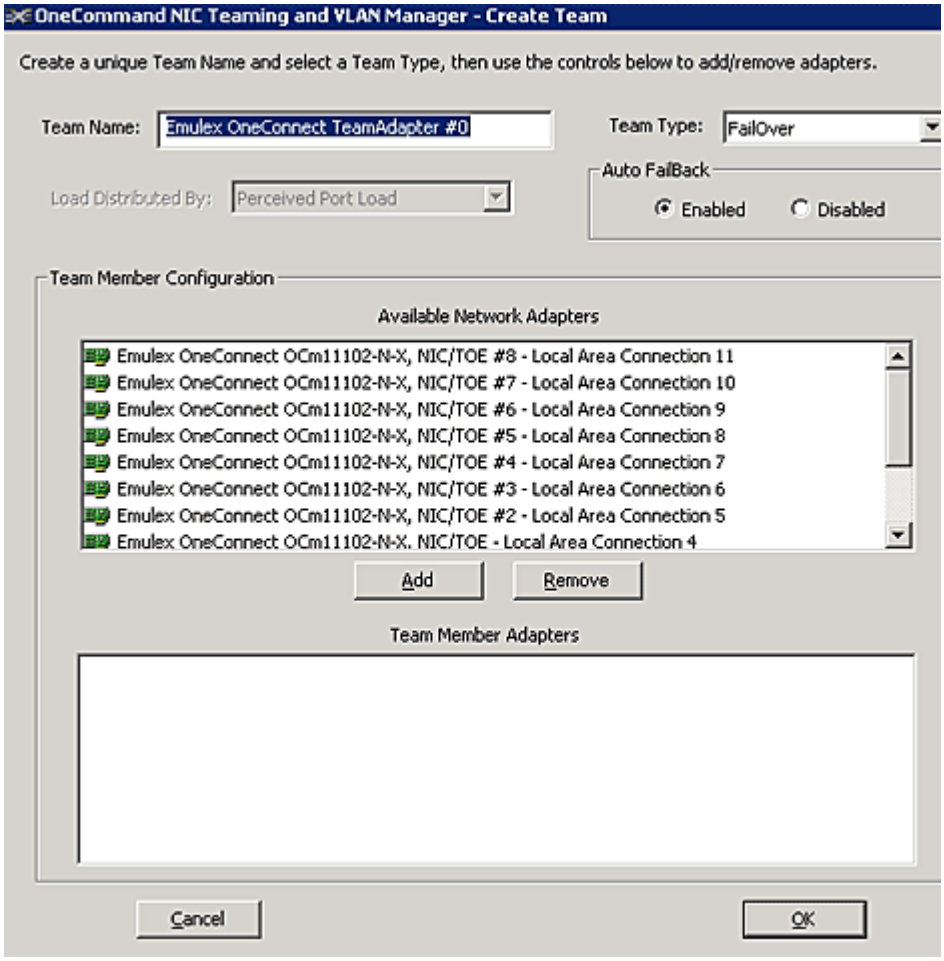

OneCommand NIC Teaming and VLAN Manager - Create Team
Create a unique Team Name and select a Team Type, then use the controls below to add/remove adapters.
Team Name:
Emulex OneConnect TeamAdapter #0
Team Type:
FailOver
Load Distributed By:
Perceived Port Load
Auto FailBack
Enabled
Disabled
Team Member Configuration
Available Network Adapters
Emulex OneConnect OCm11102-N-X, NIC/TOE #8 - Local Area Connection 11
Emulex OneConnect OCm11102-N-X, NIC/TOE #7 - Local Area Connection 10
Emulex OneConnect OCm11102-N-X, NIC/TOE #6 - Local Area Connection 9
Emulex OneConnect OCm11102-N-X, NIC/TOE #5 - Local Area Connection 8
Emulex OneConnect OCm11102-N-X, NIC/TOE #4 - Local Area Connection 7
Emulex OneConnect OCm11102-N-X, NIC/TOE #3 - Local Area Connection 6
Emulex OneConnect OCm11102-N-X, NIC/TOE #2 - Local Area Connection 5
Emulex OneConnect OCm11102-N-X, NIC/TOE - Local Area Connection 4
Add
Remove
Team Member Adapters
Cancel
OK

Figure 2: OneCommand NIC Teaming and VLAN Manager - Create Team dialog box

3. Enter a unique team name using up to 79 characters.
4. Choose a team type. Valid options:
   - Failover (For more information, see “Failover (FO)” on page 3.)
   - Load balancing (For more information, see “Smart Load Balancing [(SLB) Team Load Balancing]” on page 3.)
   - LACP (For more information, see “Switch-Controlled Teaming (Link Aggregation Control Protocol [LACP])” on page 4.)
5. For team types other than failover, select the Load Distributed By dropdown menu and select from the following:
   - Perceived Port Load - Selects the port with the least traffic load for the session.
   - Destination MAC Address - Performs an XOR on the destination MAC address to determine which port should carry the load.
   - Destination IP Address - Performs an XOR on the destination and source IP address to determine which port should carry the load.
6. When the team type selected is Failover, choose an AutoFailback mode of Enabled or Disabled.

7. The Available Network Adapters area lists adapters that are not members of any team or any VLAN bound adapter. To add an adapter to the team, select the adapter from the Available Network Adapters list and click **Add**. The adapter appears in the Team Member Adapters list. Repeat for each desired adapter in the team.

   Note: In Windows Server 2003 systems only, an adapter with a red X represents the link is down. You can add this adapter to a team and configure the team.

   Note: In Windows Server 2003 systems, an adapters with a yellow exclamation point represents a disabled adapter. In Windows Server 2008 systems, a down arrow represents a disabled adapter. You cannot add a disabled adapter to a team. A warning message is displayed if you attempt to do so.

   The Team Member Adapters area lists adapters that are members of the team.

8. Click **OK** to return to OneCommand NIC Teaming and VLAN Manager dialog box.

Primary and Secondary Adapters

Note: Every team must include at least one Emulex adapter as a primary adapter.

- To change the primary adapter of an existing team, delete the team and recreate the team.
- To change the primary adapter while creating a team, remove all adapters and add the first adapter that you would want to be the primary adapter.

Removing an Adapter during Team Creation

Caution: Removing an adapter may take several minutes. Prematurely cancelling this operation may result in partial removal of a team or VLAN. Such an act may also lead to future teaming issues or even system instability.

Note: Do not remove a team or VLAN while they are carrying traffic. If you do, unpredictable results will occur.

To remove an adapter during team creation:

1. On the OneCommand NIC Teaming and VLAN Manager - Create Team dialog box (Figure 2 on page 9), select the adapter to remove from Team Member Adapters area.
2. Click **Remove**. The adapter is removed from the Team Member Adapters area.
3. Click **OK**.

Configuring a VLAN for an Adapter

Note: Configuring the VLAN at both the physical and team level may cause double tagging.

To configure a VLAN for a physical or team adapter:

1. On the NIC Teaming and VLAN Manager dialog box (Figure 1 on page 8), select the physical (PNIC), virtual (VNIC) or a team adapter in Available Adapters to which you want to add a VLAN.
2. Click **VLAN**. The Add/Remove VLAN dialog appears.

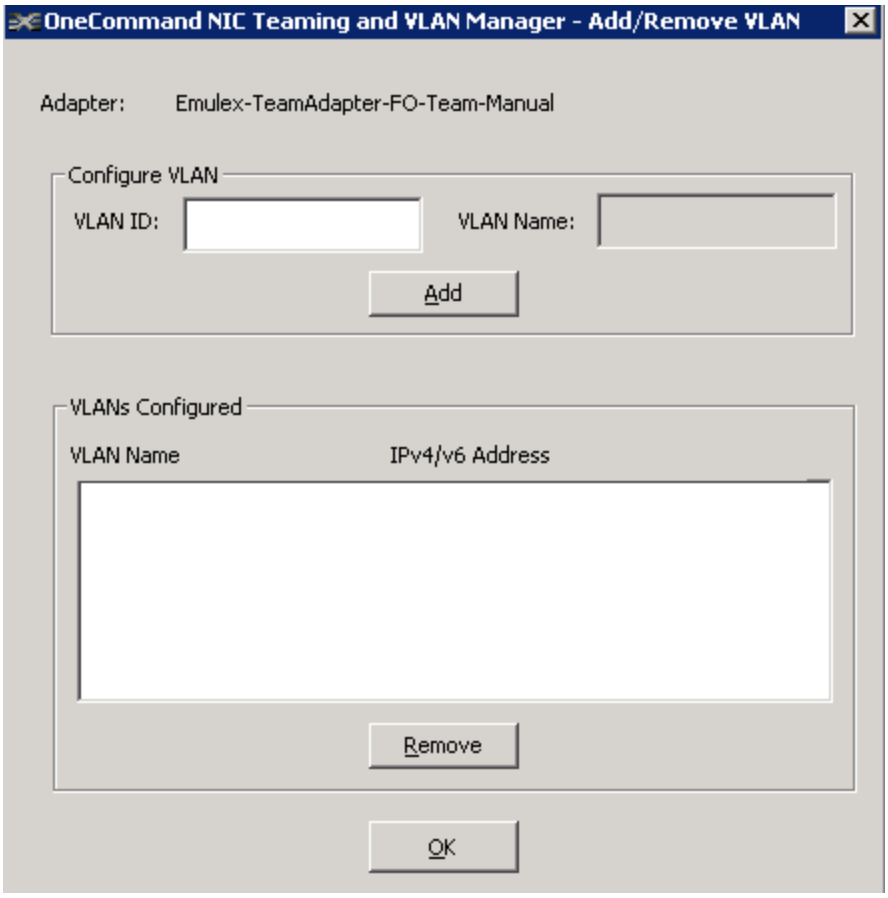


Figure 3: Add/Remove VLAN dialog box

3. Enter a VLAN ID. Valid tag values are from 1 to 4094.

   The VLAN Name shows the VLAN Name in the format VLan_<*VLAN ID*>.
4. Click **Add** to add the VLAN to the adapter. You can create up to four VLANs for an adapter. The VLANs Configured area shows the list of VLANs configured for the adapter.
5. Click **OK**. The VLAN is added to the list of configured VLANs.

   Note: Once a VLAN is added to a team, the team adapter's connection is disabled. The team adapter is marked as down (a yellow exclamation point appears in Windows Server 2003 or a down arrow in Windows Server 2008).

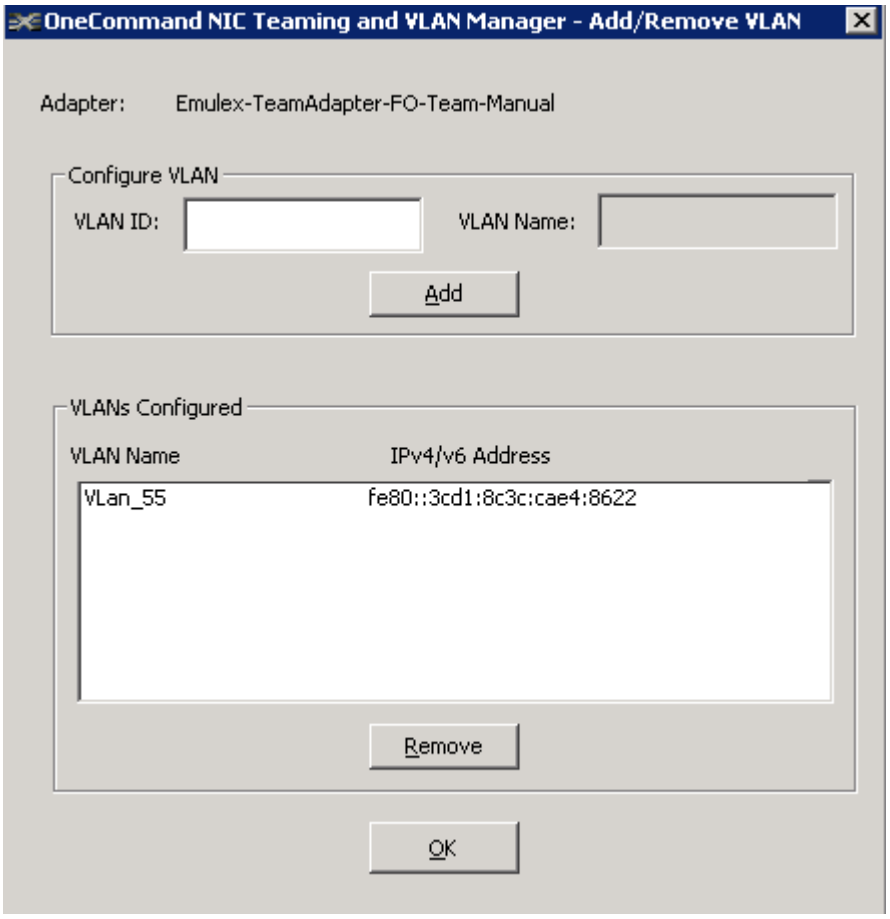


Figure 4: Configured VLANs

Removing a VLAN during VLAN Configuration

To remove a VLAN during VLAN configuration:

1. On the OneCommand NIC Teaming and VLAN Manager - Add/Remove VLAN dialog box (Figure 3 on page 11), select the adapter to remove from VLANs Configured area.

Note: Do not remove a team or VLAN while they are carrying traffic. If you do, unpredictable results will occur.

2. Click **Remove**. The adapter is removed.
3. Click **OK**.

OneCommand NIC Teaming and VLAN Manager Configuration Display

To view an adapter's current configuration:

1. On the NIC Teaming and VLAN Manager dialog box (Figure 1 on page 8), select an adapter and click **Show Configs**.

The OneCommand NIC Teaming and VLAN Manager - Configuration window is displayed. This window is read-only. Figure 5 shows a failover team with the primary adapter active.

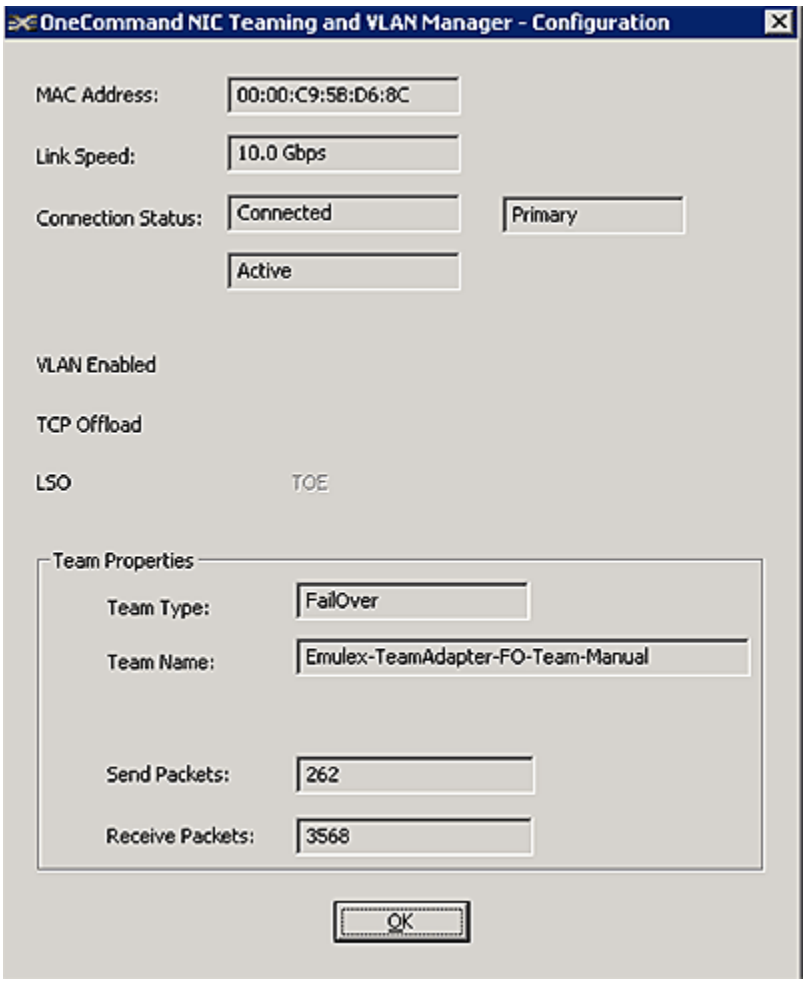


Figure 5: Teaming and VLAN Manager Configuration window

Team Member States

Each team member is in one of the following states as shown in the Connection Status field:

- Added - When a team member binds to the virtual adapter it becomes a member of a team.
- Connecting - When the team member is added, the virtual adapter queries it for the state of the physical adapter. The team member is in the connecting state.
- Connected - The virtual adapter receives a connected status for the physical adapter.
- Active - If LACP is set for the team, the LACP handshake starts and adds the link to the team.
- Disconnected - When the virtual adapter receives the link down status indication, (through LACP or because you disable or remove the link), it is disconnected and releases the IP address. The virtual adapter is no longer a member of the team.
- Deleted - If the adapter is disconnected, you can delete it. If you delete a team member or the whole team, the virtual adapter enters this state. It is no longer a member of the team.

Using Teamed Adapters in Hyper-V

Exporting a team without a VLAN to a VM

Hyper-V must be installed to use Emulex teamed adapters in Hyper-V.

To export a team without a VLAN to a virtual machine:

1. Create and install a VM. In this example, Windows Network Manager is used.
2. Create a team using OneCommand NIC Teaming and VLAN Manager or OCTeamCmd.
3. Open Hyper-V Manager and select **Virtual Network Manager**.

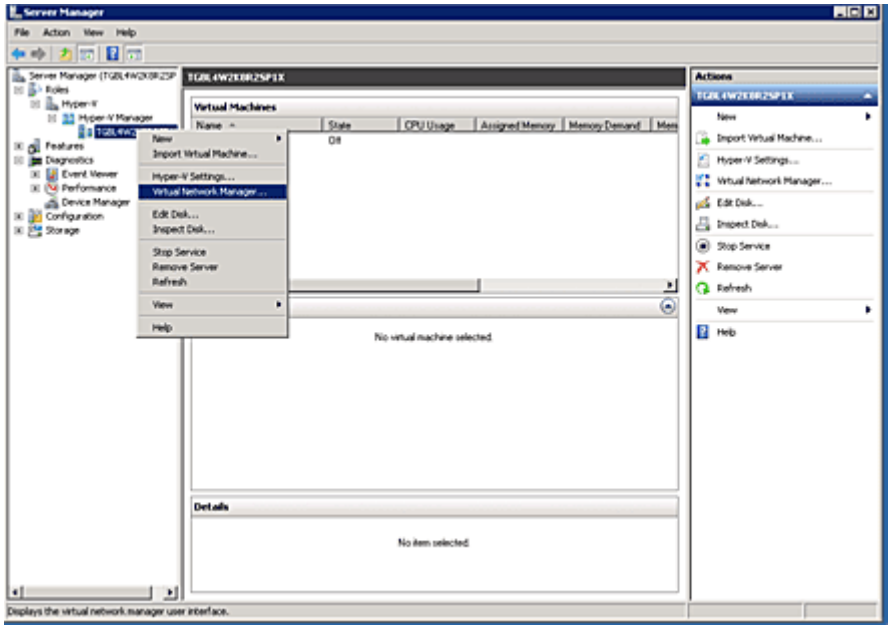


Figure 6: Hyper-V Manager menu

4. The Create virtual network page is displayed. Select **External** and click **Add**.

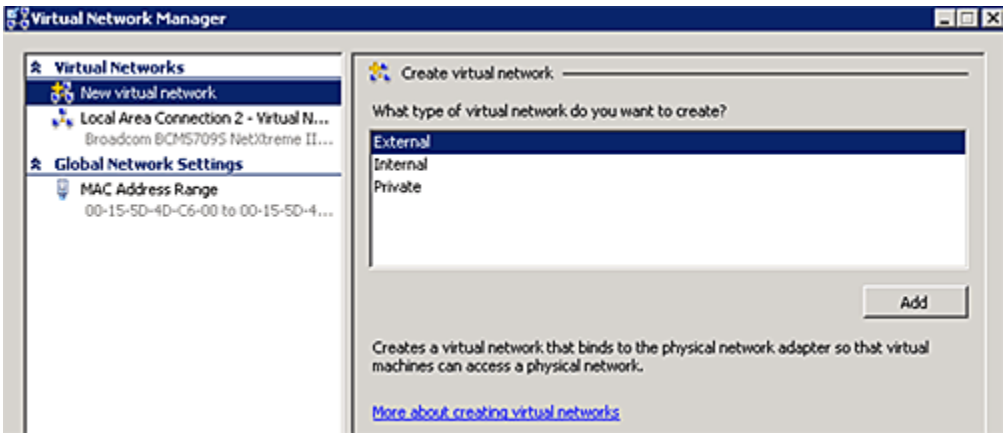

Virtual Network Manager
Virtual Networks
New virtual network
Local Area Connection 2 - Virtual N...
Broadcom BCM5709S NetXtreme II...
Global Network Settings
MAC Address Range
00-15-5D-4D-C6-00 to 00-15-5D-4...
Create virtual network
What type of virtual network do you want to create?
External
Internal
Private
Add
Creates a virtual network that binds to the physical network adapter so that virtual machines can access a physical network.
More about creating virtual networks

Figure 7: Hyper-V Manager, Create virtual network options

The New Virtual Network page is displayed.

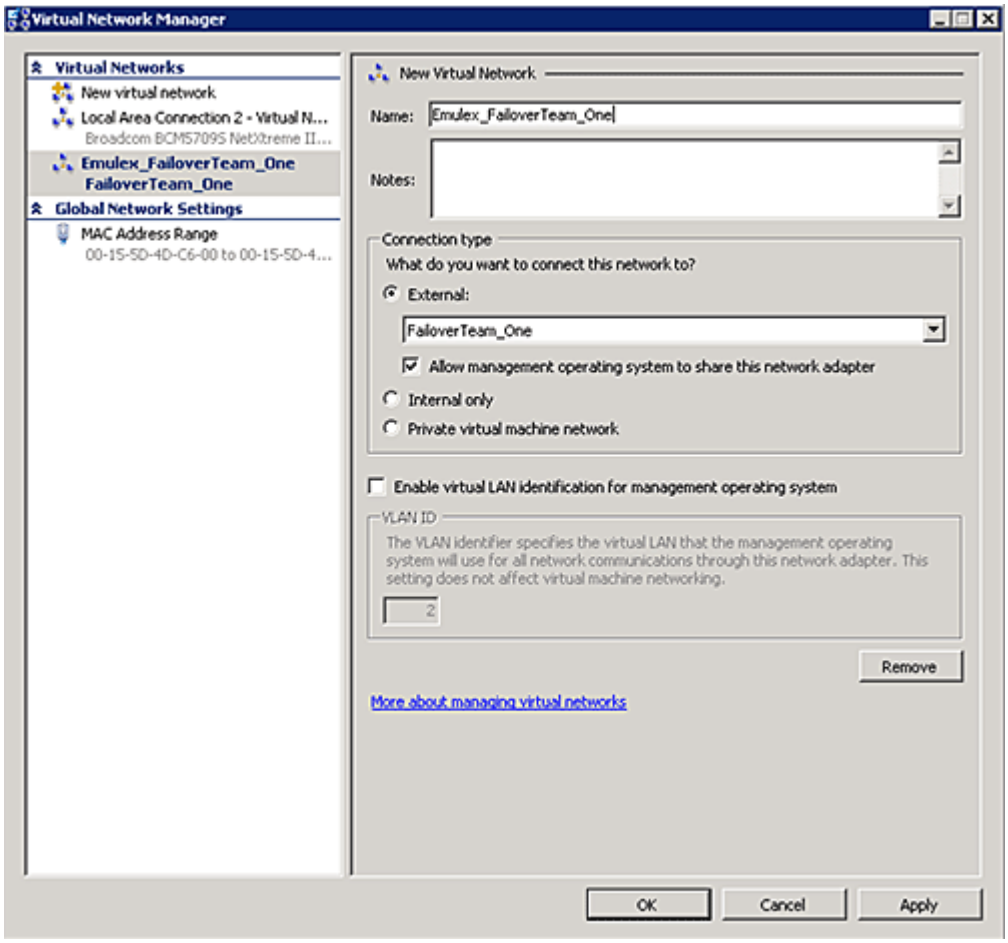


Figure 8: New Virtual Network page, without a VLAN

5. Enter the name of the new network (Figure 8 shows Emulex_Failover_Team_One).
6. Select the **External** radio button and select an Emulex adapter.
7. Select the **Allow management operating system to share the network adapter** check box.
8. Clear the **Enable virtual LAN identification for management operating systems** check box.
9. Click **Apply**.
10. Ensure that the virtual machine is turned off.

11. On the Virtual Machines page, select **Settings**.

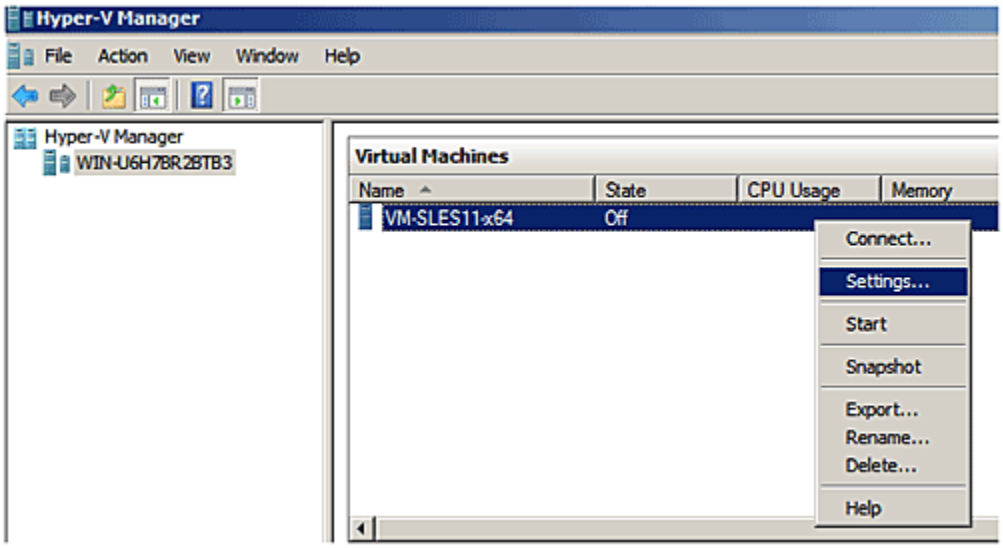


Figure 9: Hyper-V Manager, Virtual Machines page.

The Settings for the virtual machine page are displayed.

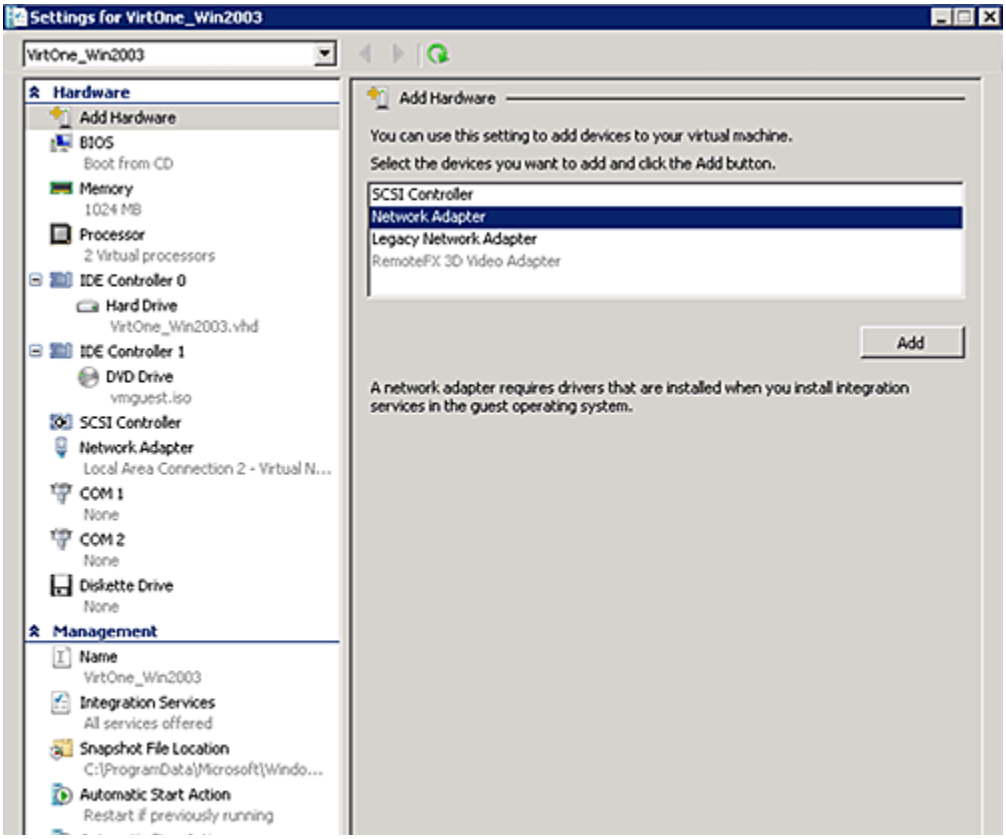


Figure 10: Hyper-V Manager, Settings for a virtual machine page

Note: Figure 10 shows a network adapter. To use a network adapter, you may need to install integration services in the guest operating system.

12. In the left pane, select **Add Hardware**.

13. In the right pane, select a network adapter and click **Add**. The Network Adapter page is displayed.

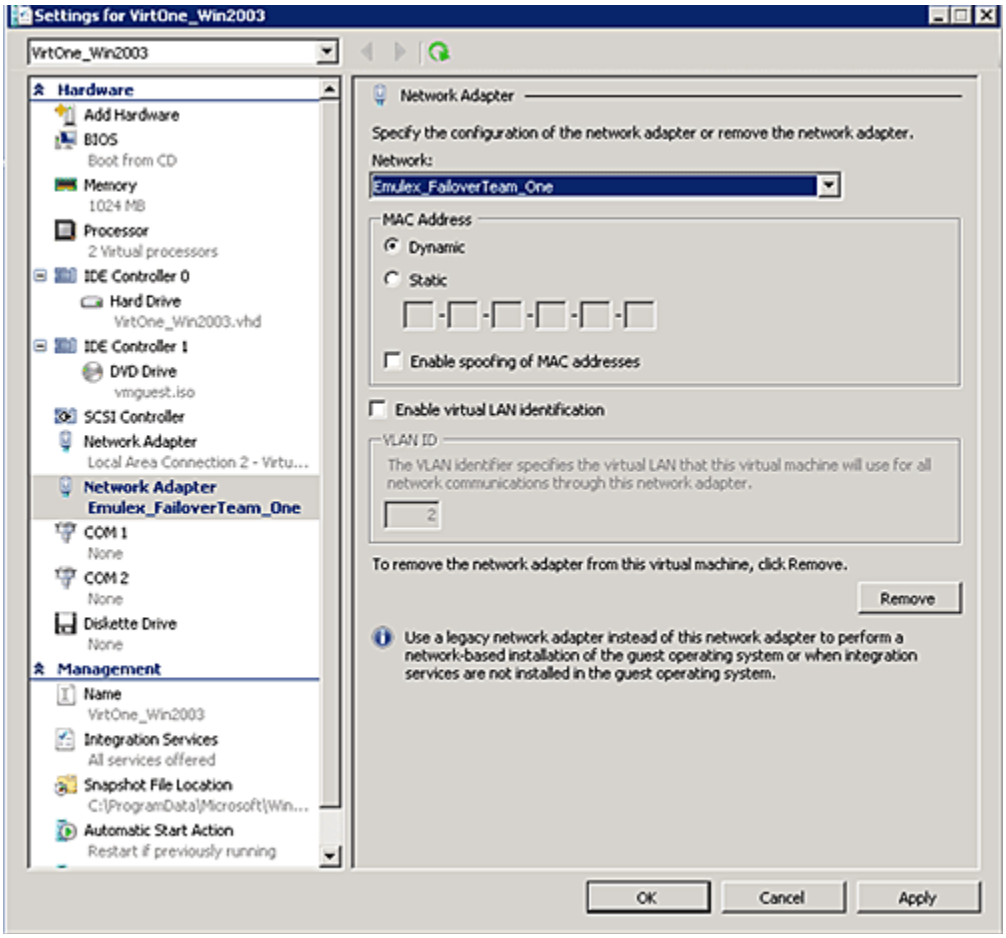


Figure 11: Network Adapter page

14. Select the virtual network that you created and click **Apply**.
15. Turn on and connect to the virtual machine.

16. Verify the new network adapter. From the desktop start menu, click **Control Panel>Administrative Tools>Computer Managerment>Device Manager**. Select **Network adapters** in the right pane.

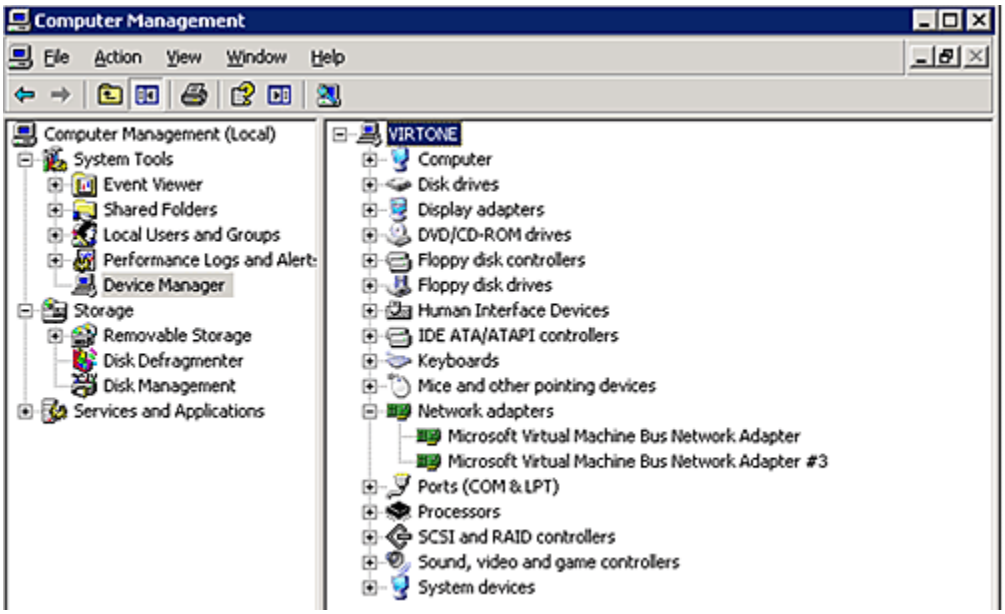


Figure 12: Device Manager

17. Check the network connections. From the command prompt, enter the ipconfig command. A new network connection/adapter appears in the virtual machine.

```
Microsoft Windows [Version 5.2.3790]
(C) Copyright 1985-2003 Microsoft Corp.

C:\Documents and Settings\Administrator>ipconfig

Windows IP Configuration


Ethernet adapter Local Area Connection:

   Connection-specific DNS Suffix  . : lab.emulex.com
   IP Address. . . . . . . . . . . . : 10.192.76.61
   Subnet Mask . . . . . . . . . . . : 255.255.240.0
   Default Gateway . . . . . . . . . : 10.192.64.254

Ethernet adapter Local Area Connection 3:

   Connection-specific DNS Suffix  . :
   IP Address. . . . . . . . . . . . : 23.1.100.64
   Subnet Mask . . . . . . . . . . . : 255.0.0.0
   Default Gateway . . . . . . . . . :

C:\Documents and Settings\Administrator>_
```

Figure 13: Network Connection information

Exporting a team with a VLAN to a Virtual Machine

Hyper-V must be installed to use Emulex teamed adapters in Hyper-V.

To export a team with a VLAN to a virtual machine:

1. Create a team using OneCommand NIC Teaming and VLAN Manager or OCTeamCmd. For more information, see “Creating, Configuring and Removing Teams” on page 7.

2. Add a VLAN to the team using OneCommand NIC Teaming and VLAN Manager or OCTeamCmd. For more information, see “Configuring a VLAN for an Adapter” on page 11.
3. Open Hyper-V Manager and select **Virtual Network Manager**. (Figure 6 on page 14)
4. The Create virtual network page is displayed. Select **External** and click **Add.** (Figure 7 on page 14)
5. The New Virtual Network window is displayed.

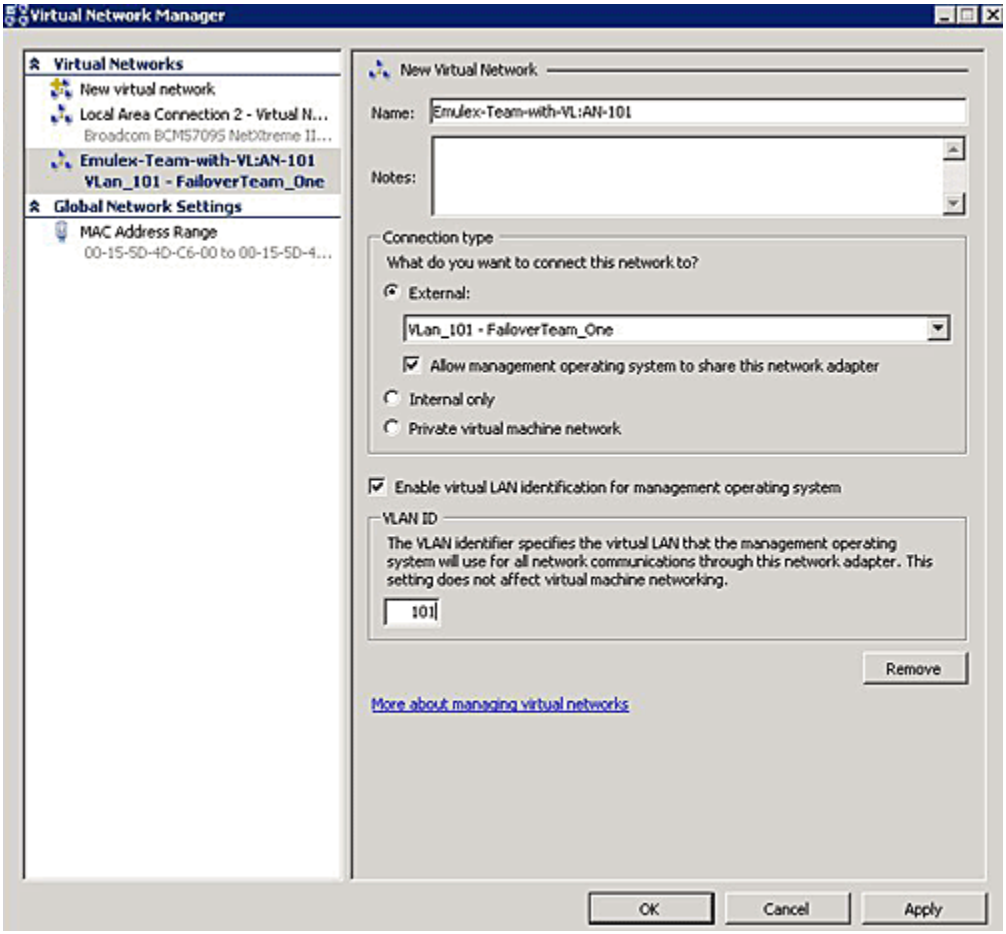


Figure 14: New Virtual Network page, exporting with a VLAN

6. Enter the name of the new network (for example, Emulex-Teamed-with-VLAN-101).
7. In the Connection Type area, select the **External** radio button and select an Emulex adapter. with VLAN.
8. Check the **Enable virtual LAN identification for management operating systems** check box.
9. In the VLAN ID field enter the same VLAN ID that you used for the team.
10. Click **Apply**.
11. Ensure that the virtual machine is turned off.
12. On the Virtual Machines page, select **Settings** (Figure 9 on page 16).
13. In the left pane, select **Add Hardware** (Figure 10 on page 16).

14. In the right pane, select the network adapter and click **Add**. The Network Adapter page is displayed.

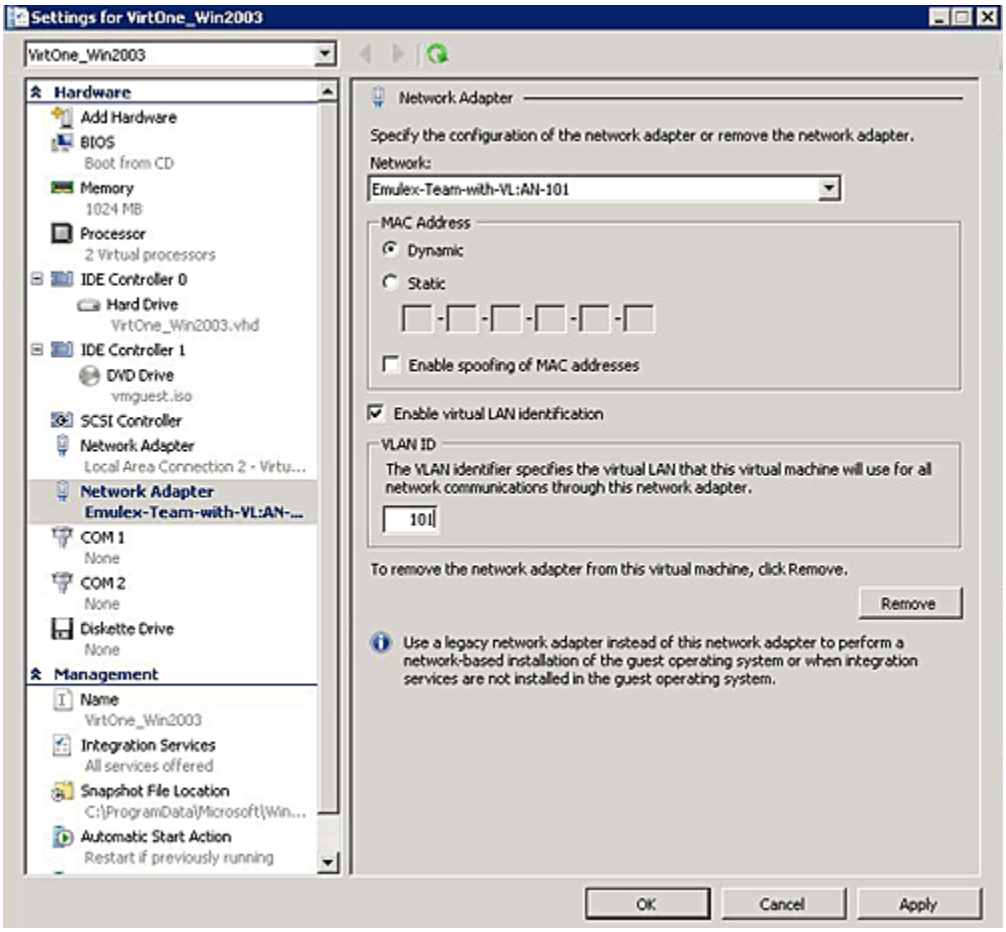


Figure 15: The Network Adapter page, exporting with a VLAN

Note: For best performance use a network adapter (as defined by Microsoft for Hyper-V on Windows Server 2008 and later). To use a network adapter, you may need to install integration services in the guest operating system.

15. Enter the name of the new network (for example, Emulex-Teamed-with-VLAN-101).
16. Check the **Enable virtual LAN identification** check box.
17. In the VLAN ID field enter the same VLAN ID that you used for the team.
18. Click **Apply**.
19. Turn on and connect to the virtual machine. Check the network connections. A new network connection/adapter will appear in the virtual machine. (Figure 13 on page 18).

OneCommand NIC Teaming Driver Command Line Interface

Introduction

The OneCommand™ NIC Teaming Driver Command Line Interface (OCTeamCmd) is a companion to the OneCommand NIC Teaming and VLAN Manager. Use the OCTeamCmd in scripted operations from within shell scripts or batch files.

Each time you run this application from the command line, a single operation is performed. The first parameter of this command is the requested operation. When the specified operation is completed, the command prompt is displayed. Some of the OCTeamCmd commands require one or more additional parameters that specify the nature of the command.

Adapter Aliases and Team Identification

Adapters are identified within Windows by using the adapter name.

The OCTeamCmd also uses aliases to identify physical adapters. Adapter aliases are assigned by the OCTeamCmd as adapters are discovered and take the form of '*nicX*' where 'X' is a unique integer. Adapter aliases, once assigned, exist for as long as the adapter's GUID does not change. Any events that cause Windows to treat an existing adapter as if it is newly installed, causes a new alias to be assigned to that adapter the next time a OCTeamCmd command is executed.

Network Connection Names

Windows assigns each adapter and team a Network Connection Name. In most versions of Windows the name defaults to the form of '*Local Area Connection N*'.

To view the Network Connection Name from the desktop:

1. Select: **All Programs>My Network Places**.
2. Right click on the adapter and click **Properties**. The Network Connection Name is labeled by the operating system in a format similar to *Local Area Connection #N*.
3. You can rename these network connections with the tools provided by the operating system. You can also use the Network Connection Name as an alias when identifying adapters or teams in OCTeamCmd commands. If the name contains spaces, enclose the entire name in double quotes.

Note: Network Connection Names are not stored by the OCTeamCmd. They are maintained by Windows.

Syntax Rules

- Key words - Key words determine which command to execute, but do not specify any command parameters. Keywords are shown in plain text.
- Mandatory items - Angle brackets represent mandatory, but variable items. For example, <*filename*> is a place in a command where you must supply a filename.
- Optional items - Curly brackets represent optional items. For example, 'octeamcmd help {*command name*}' shows that the help command can accept a command name as an optional parameter.
- List of choices - If a command parameter may be one of several items, those items are separated by a vertical bar '|'. For example, 'blue | green | red' indicates that you may use 'blue', 'green' or 'red'. When selection from a list is mandatory, the entire list is enclosed in angle brackets. A list of optional items would be enclosed in curly brackets.
- Team-id - Where a team name is placed in a command.

- Adapter-id - Where an adapter alias is placed in a command.
- Adapter-list - Where a list of adapter aliases are placed in a command. Aliases in a list are separated by one or more spaces.
- Network Manager - Also known as the Network Connection Name.
- Hash - Shows where a hashing algorithm is specified in a command. For a list of supported hashing algorithms, see Table 2 on page 30.
- VLAN-id - This number represents the VLAN tag.
- VLAN alias -The name that represents a VLAN that is automatically generated when a VLAN is created. The name takes the form of "*VLan_n*" where *n* is the VLAN's VLAN-id.

Error Codes

Table 1: OneCommand NIC Teaming Driver and Command Line Utility Error Codes

Hexadecimal Error Code	Signed Decimal Value	Unsigned Decimal Value	Description
0x00000000		0	No errors.
0x8F000001	-1895825407	2399141889	The OneCommand NIC Teaming and VLAN Manager is running. The OneCommand NIC Teaming and VLAN Manager and the OCTeamCmd utility cannot run at the same time.
0x8F000002	-1895825406	2399141890	The OneCommand NIC Teaming and VLAN Manager Uninstaller is running. The OneCommand NIC Teaming and VLAN Manager Uninstaller and the OCTeamCmd utility cannot run at the same time.
0x8F000003	-1895825405	2399141891	The OneCommand NIC Teaming and VLAN Manager Update utility is running. The OneCommand NIC Teaming and VLAN Manager Update utility and the OCTeamCmd utility cannot run at the same time.
0x8F000004	-1895825404	2399141892	Another copy of the OCTeamCmd utility is running, only one can run at a time.
0x8F000005	-1895825403	2399141893	Initialization of Windows Common Controls failed.
0x8F000006	-1895825402	2399141894	The OneCommand NIC Teaming and VLAN Manager is not installed. Presence of the driver is required for OCTeamCmd utility operation.
0x8F000008	-1895825400	2399141896	The file cannot be found.
0x8F000009	-1895825399	2399141897	There are too many arguments specified on the command line.
0x8F00000A	-1895825398	2399141898	The command is not recognized.
0x8F00000B	-1895825397	2399141899	The specified directory cannot be found.
0x8F00000C	-1895825396	2399141900	Windows does not allow the file to open.
0x8F000013	-1895825389	2399141907	No teams exist on the system.

Table 1: OneCommand NIC Teaming Driver and Command Line Utility Error Codes (Continued)

Hexadecimal Error Code	Signed Decimal Value	Unsigned Decimal Value	Description
0x8F000014	-1895825388	2399141908	There is an invalid number of command arguments.
0x8F000015	-1895825387	2399141909	Required data is not found on the command line.
0x8F000016	-1895825386	2399141910	The team type is not provided
0x8F000017	-1895825385	2399141911	An invalid hash value is specified.
0x8F000018	-1895825384	2399141912	The provided number of members did not fall in the required range for the requested team type.
0x8F000019	-1895825383	2399141913	The adapter ID is invalid.
0x8F00001A	-1895825382	2399141914	The team-ID is either missing or invalid.
0x8F00001B	-1895825381	2399141915	The team-ID exceeds the maximum string length of 39 characters.
0x8F00001C	-1895825380	2399141916	The team-ID/adapter-ID is invalid or missing.
0x8F00001D	-1895825379	2399141917	The team-ID/adapter-ID is not found.
0x8F00001E	-1895825378	2399141918	The VLAN value or ID is invalid.
0x8F00001F	-1895825377	2399141919	The hash value may be invalid or the internal structure may need to be updated.
0x8F000020	-1895825376	2399141920	The team type may be invalid or the internal structure may need to be updated.
0x8F000021	-1895825375	2399141921	Failure to retrieve the list of free adapters on the system.
0x8F000022	-1895825374	2399141922	Failure to retrieve the list of bound adapters on the system.
0x8F000023	-1895825373	2399141923	Failed to retrieve the adapter alias list from the system.
0x8F000024	-1895825372	2399141924	Failed to create alias for one of the adapters.
0x8F000025	-1895825371	2399141925	Failed to create a team alias.
0x8F000026	-1895825370	2399141926	Failed to retrieve a team alias list.
0x8F000027	-1895825369	2399141927	Failed to read alias information from the registry.
0x8F000028	-1895825368	2399141928	The team name is not unique. There is already a team or adapter with this name or alias.
0x8F000029	-1895825367	2399141929	<*Code Error*> The primary team is not set by the calling function.
0x8F00002A	-1895825366	2399141930	One of the team members does not exist or does not have link.

Table 1: OneCommand NIC Teaming Driver and Command Line Utility Error Codes (Continued)

Hexadecimal Error Code	Signed Decimal Value	Unsigned Decimal Value	Description
0x8F00002B	-1895825365	2399141931	The primary adapter is not an Emulex adapter.
0x8F00002C	-1895825364	2399141932	The adapter's link is not enabled by the calling function.
0x8F00002D	-1895825363	2399141933	One of the team members is already bound and is not available for use by another team.
0x8F00002E	-1895825362	2399141934	The primary adapter is not set to active by the calling function.
0x8F00002F	-1895825361	2399141935	The secondary adapter in failover mode is not set to passive by the calling function.
0x8F000030	-1895825360	2399141936	The wrong number of members is set by the calling function.
0x8F000031	-1895825359	2399141937	The failover type provided to the create command is unknown.
0x8F000032	-1895825358	2399141938	Unable to determine whether an adapter is enabled or disabled.
0x8F000033	-1895825357	2399141939	An adapter is disabled.
0x8F000034	-1895825356	2399141940	An internal error is detected. Check the debug log.
0x8F000035	-1895825355	2399141941	A timeout occurred while waiting for Windows to delete a team. The deletion may have completed, but it did not complete within five minutes.
0x8F000036	-1895825354	2399141942	A timeout occurred while waiting for Windows to delete a VLAN. The deletion may have completed, but it did not complete within five minutes.
0x8F000037	-1895825353	2399141943	A reboot is needed for just made changes to take effect.
0x8F000038	-1895825352	2399141944	A reboot request is pending. It is not safe to make NIC teaming configuration changes while the Windows operating system is in this state.
0x8F000039	-1895825351	2399141945	The OneCommand NIC Teaming and VLAN Manager cannot be uninstalled while teams or VLANs are defined. The teams or VLANs must be deleted first.
0x8F00003A	-1895825350	2399141946	The team name is not unique.
0x8F00003B	-1895825349	2399141947	The command line interface cannot be found.
0x8F00003C	-1895825348	2399141948	The application is invoked without administrator privileges.

Table 1: OneCommand NIC Teaming Driver and Command Line Utility Error Codes (Continued)

Hexadecimal Error Code	Signed Decimal Value	Unsigned Decimal Value	Description
0x8F00003D	-1895825347	2399141949	The number of teams configured is already at the maximum allowed.
0x8F00003E	-1895825346	2399141950	The number of VLANs configured is already at the maximum allowed.
0x8F00003F	-1895825345	2399141951	A value on the command line cannot be converted to a numeric value. Verify that values are correct.
0x8F000040	-1895825344	2399141952	VLANs cannot be assigned to this adapter because the adapter is a team member, disabled or cannot be found.
0x8F000041	-1895825343	2399141953	One or more of the VLAN IDs are already in use by this adapter or team.
0x8F000042	-1895825342	2399141954	The adapter or team has no VLANs assigned to it.
0x8F000043	-1895825341	2399141955	No VLAN bound adapters are defined.
0x8F000044	-1895825340	2399141956	VLANs cannot be added to team members.
0x8F000045	-1895825339	2399141957	An error occurred during application initialization.
0x8F000046	-1895825338	2399141958	An error occurred while cleaning the registry.
0x8F000047	-1895825337	2399141959	The adapter ID specified is invalid or already bound.
0x8F000049	-1895825335	2399141961	An application has locked Windows networking, therefore teaming configuration changes cannot be made.
0x8F00004A	-1895825334	2399141962	Exceeds the number of VLANs allowed.
0x8F00004B	-1895825333	2399141963	Failed to find the alias for the required adapter.

Note: You must convert return codes to hexadecimal and ignore the high order bits to accurately cross-reference your error codes with those documented in Table 1.

The Command Reference

Help

Syntax:

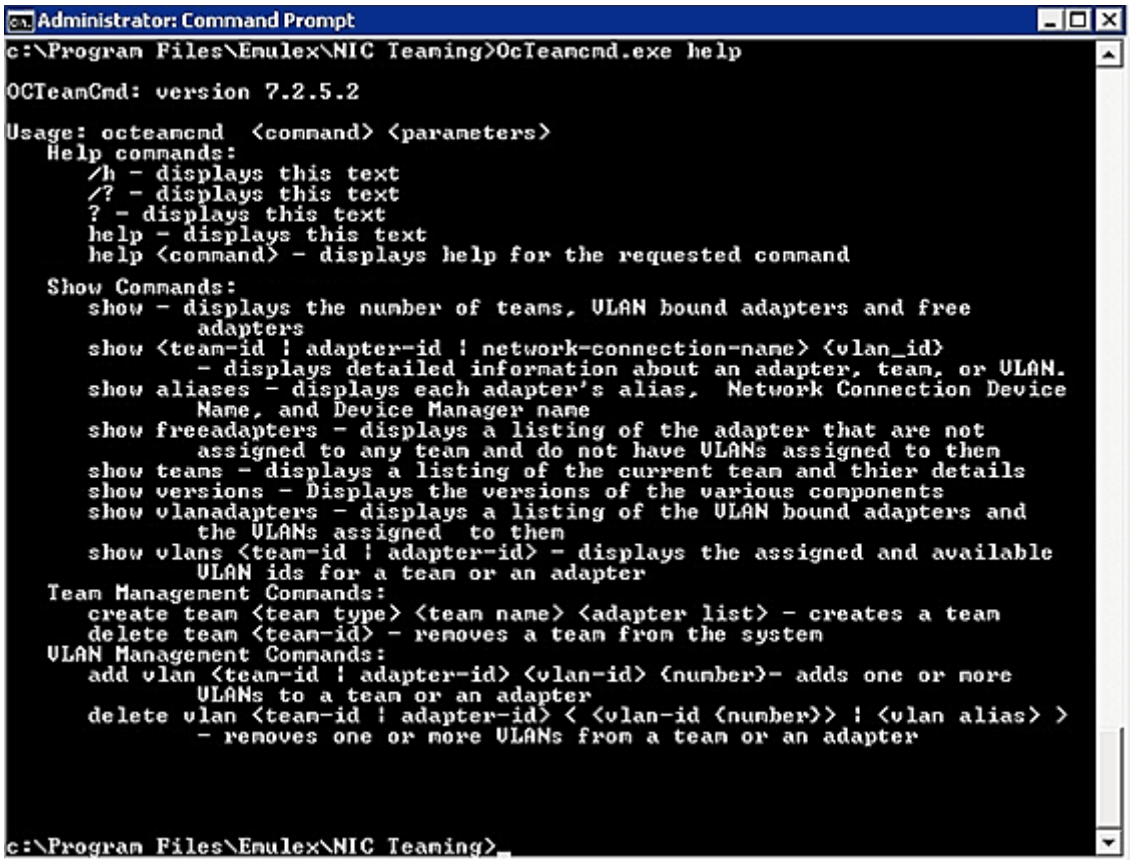
```
OCTeamCmd.exe help {command}
```

Description: The OCTeamCmd.exe help command without any parameters or with the command line options of ‘help’, ‘/h’ or ‘/?’ lists the utility’s version and all OCTeamCmd commands.

Parameters:

{command} - The name of the CLI command. Use this argument to show help for a specific command.

Example of help with no optional command:



Showing NIC Teaming and VLAN Configurations

Syntax:

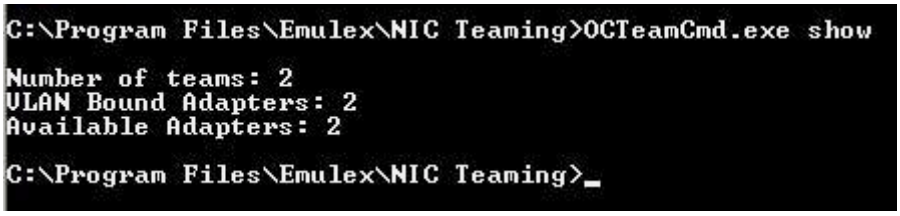
```
OCTeamCmd.exe show
```

Description: This command shows a summary of the overall NIC teaming and VLAN configurations.

Parameters:

None.

Example:



Showing Aliases

Syntax:

```
OCTeamCmd.exe show aliases
```

Description: This command shows the adapter's alias, device manager name and network connection device name.

Parameters:

None.

Example:

```
C:\Program Files\Emulex\NIC Teaming>OCTeamCmd.exe show aliases

Alias:  nic5
  Device Manager Name: Emulex OneConnect OCe10102-I, NIC/TOE
  Network Conn. Device Name: Local Area Connection 7
Alias:  nic4
  Device Manager Name: myteam3 - Emulex OneConnect OCe10102-F, NIC/TOE #2
  Network Conn. Device Name: Local Area Connection 6
Alias:  nic6
  Device Manager Name: myteam3 - Emulex OneConnect OCe10102-I, NIC/TOE #2
  Network Conn. Device Name: Local Area Connection 8
Alias:  nic1
  Device Manager Name: HP NC382i DP Multifunction Gigabit Server Adapter
  Network Conn. Device Name: Local Area Connection - do not team
Alias:  nic7
  Device Manager Name: HP NC382i DP Multifunction Gigabit Server Adapter #2
  Network Conn. Device Name: Local Area Connection 2
Alias:  nic2
  Device Manager Name: HP NC382i DP Multifunction Gigabit Server Adapter #3
  Network Conn. Device Name: Local Area Connection 3
Alias:  nic3
  Device Manager Name: HP NC382i DP Multifunction Gigabit Server Adapter #4
  Network Conn. Device Name: Local Area Connection 4
Alias:  nic8
  Device Manager Name: Emulex OneConnect OCe10102-F, NIC/TOE
  Network Conn. Device Name: Local Area Connection 5
```

Show Teams

Syntax:

`OCTeamCmd.exe show teams`

Description: This command lists all teams including their team type, team members and assigned VLANs. Teams are identified using the team name and network manager (network connection name).

Parameters:

None

Example:

```
C:\Program Files\Emulex\NIC Teaming>OCTeamCmd.exe show teams

Device Manager Name: mylbteam
Network Conn. Device Name: not available
Connection Status: not connected
Team type: Load Balancing                   Hash type: destip
MAC Address:                                Link Speed:
Packet Sent:                                Packets Received:
Members:
  Emulex OneConnect OCe10102-F, NIC/TOE - Local Area Connection 5
  HP NC382i DP Multifunction Gigabit Server Adapter #4 - Local Area Connection 4

VLANs:
  VLAN_6              169.254.170.13
  VLAN_5              169.254.4.167
  VLAN_4              169.254.0.0
  VLAN_3              169.254.173.62

Device Manager Name: myteam3
Network Conn. Device Name: Local Area Connection 17
Connection Status: connected
Team type: Failover                         Automatic Failback: enabled
MAC Address: 00:00:C9:9D:A4:9C              Link Speed: 10.0 Gbps
Packet Sent: 163                            Packets Received: 8383
Members:
  Emulex OneConnect OCe10102-I, NIC/TOE #2 - Local Area Connection 8
  Emulex OneConnect OCe10102-F, NIC/TOE #2 - Local Area Connection 6
VLANs:
```

Showing VLAN Adapters

Syntax:

```
OCTeamCmd.exe show vlanadapters
```

Description: This command shows all VLAN bound adapters and the VLANs assigned to them. Adapters are identified using their name, network manager (network connection name) and alias.

Example:

```
C:\Program Files\Emulex\NIC Teaming>OCTeamCmd.exe show vlanadapters

Alias:  nic5
Device Manager Name: Emulex OneConnect OCe10102-I, NIC/TOE
Network Conn. Device Name: Local Area Connection 7
Connection Status: connected
Adapter type: VLAN Bound
MAC Address: 00:00:C9:9D:A4:6A          Link Speed: 10.0 Gbps
Packet Sent: 4578                       Packets Received: 295851
VLANs:
  VLAN_3              169.254.28.197
```

Showing Free Adapters

Syntax:

```
OCTeamCmd.exe show freeadapters
```

Description: This command shows a listing of adapters that are not assigned to a team and do not have any assigned VLANs. Adapters are identified using their name, network manager (network connection name) and alias.

Parameters:

None.

Example:

```
C:\Program Files\Emulex\NIC Teaming>OCTeamCmd.exe show freeadapters

Alias:  nic1
  Device Manager Name: HP NC382i DP Multifunction Gigabit Server Adapter
  Network Conn. Device Name: Local Area Connection - do not team
Alias:  nic7
  Device Manager Name: HP NC382i DP Multifunction Gigabit Server Adapter #2
  Network Conn. Device Name: Local Area Connection 2
Alias:  nic2
  Device Manager Name: HP NC382i DP Multifunction Gigabit Server Adapter #3
  Network Conn. Device Name: Local Area Connection 3
Alias:  nic3
  Device Manager Name: HP NC382i DP Multifunction Gigabit Server Adapter #4
  Network Conn. Device Name: Local Area Connection 4
Alias:  nic8
  Device Manager Name: Emulex OneConnect OCe10102-F, NIC/TOE
  Network Conn. Device Name: Local Area Connection 5
```

Showing Team or Adapter Details

Syntax:

```
show <team-id |adapter-id | network-connection-name> {vlan-id}
```

Description: This command shows details about a team or an adapter. Optionally, to show information about a VLAN, you must first specify an adapter or team, and then specify the VLAN ID. You may use a numeric value or a string to identify the VLAN.

Parameters:

Team-id - Team name.

Adapter-id - Adapter alias assigned by OCTeamCMD.

Network-connection-name -network manager. This name is not stored by OCTeamCMD. This name is maintained by Windows.

{Vlan-id} - The number used as the VLAN tag.

Example:

C:\Program Files\Emulex\NIC Teaming>OCTeamCmd.exe show "Local Area Co
Device Manager Name: Emulex OneConnect OCe10102-F, NIC/TOE
Network Conn. Device Name: Local Area Connection 5
Connection Status: connected
Team: mylbteam
Team type: Load Balancing
Hash type: destip
Adapter Role: Secondary
Adapter Status: Passive
MAC Address: 00:00:C9:9D:A4:9A
Link Speed: 10.0 Gbps
Packet Sent: 146
Packets Received: 1098
C:\Program Files\Emulex\NIC Teaming>OCTeamCmd.exe show myteam3
Device Manager Name: myteam3
Network Conn. Device Name: Local Area Connection 17
Connection Status: connected
Team type: Failover
Automatic Failback: enabled
MAC Address: 00:00:C9:9D:A4:9C
Link Speed: 10.0 Gbps
Packet Sent: 155
Packets Received: 7009
Members:
Emulex OneConnect OCe10102-I, NIC/TOE #2 - Local Area Connection 8
Emulex OneConnect OCe10102-F, NIC/TOE #2 - Local Area Connection 6
VLANs:
C:\Program Files\Emulex\NIC Teaming>OCTeamCmd.exe show nic5
Device Manager Name: Emulex OneConnect OCe10102-I, NIC/TOE
Network Conn. Device Name: Local Area Connection 7
Connection Status: connected
Adapter type: VLAN Bound
MAC Address: 00:00:C9:9D:A4:6A
Link Speed: 10.0 Gbps
Packet Sent: 4560
Packets Received: 294992
VLANs:
VLAN_3
169.254.28.197

Showing VLAN IDs

Syntax:

```
show vlans <team-id | adapter-id>
```

Description: This command shows a listing of VLAN IDs that are currently in use and those that are available for use.

Parameters:

Adapter id - Adapter alias assigned by OCTeamCMD

Team-id - The name assigned to a team when it is created.

Example:

```
C:\Program Files\Emulex\NIC Teaming>OCTeamCmd.exe show vlans nic5

Used VLAN IDs:
    3

Available VLAN IDs:
    1-2, 4-4094

C:\Program Files\Emulex\NIC Teaming>OCTeamCmd.exe show vlans mylbteam

Used VLAN IDs:
    3, 4, 5, 6

Available VLAN IDs:
    1-2, 7-4094
```

Creating a Team

Caution: Creating an adapter may take several minutes. Prematurely cancelling this operation may result in partial removal of a team or VLAN. Such an act may also lead to future teaming issues or even system instability

Syntax:

```
create team  <failover:<auto-failback-setting> |  loadbalance:<hash> |  802.3ad:<hash>
|  LACP:<hash> > team-name adapter- list
```

Description: This command creates a team. The team-name is the name for the team that is to be created. The name cannot exceed 80 characters and must be unique. The adapters listed as part of the team may not be part of another team and may not have VLANs assigned to them. The first adapter listed becomes the primary adapter; this must be an Emulex adapter. The number of allowable team members varies with team type. Failover teams must have 2 members. Load balancing teams must have from 2 to 8 members. LACP and 802.3ad teams must have from 2 to 4 members. The auto-failback-setting is only used for failover teams. This setting specifies whether the team should automatically resume using the primary adapter once it becomes available again after the team has failed over to the secondary adapter.

A maximum of 4 teams can be created. Use the abbreviated names from Table 2 when specifying the team type on Load Balancing, LACP and 802.3ad teams from the command line.

Table 2: Hash Algorithms

Hash Algorithm	Abbreviation
Perceived adapter load	percload
Destination MAC	destmac
Destination IP	destip

Parameters:

Auto-failback-setting - fbenable or fbdisabled

Hash - Hash algorithm

Example:

```
C:\Program Files\Emulex\NIC Teaming>OCTeamCmd.exe create team  failover :auto
am nic4 nic6

Successfully created team: myteam


C:\Program Files\Emulex\NIC Teaming>_
```

Deleting a Team

Caution: Removing an adapter may take several minutes. Prematurely cancelling this operation may result in partial removal of a team or VLAN. Such an act may also lead to future teaming issues or even system instability.

Note: Do not remove a team or VLAN while they are carrying traffic. If you do, unpredictable results will occur.

Syntax:

```
delete team <team-id>
```

Description: This command deletes a team from the system and deletes any VLANs assigned to the team.

Parameters:

Team-id - Team to be deleted.

Example:

```
C:\Program Files\Emulex\NIC Teaming>OCTeamCmd.exe delete team mylbteam

Successfully deleted team: mylbteam

C:\Program Files\Emulex\NIC Teaming>_
```

Adding a VLAN

Syntax:

```
add vlan <team-id |adapter-id> < vlan-id> {number}
```

Description: This command assigns one or more VLANs to a team or an adapter. You can only assign a VLAN to teams and Emulex adapters. A VLAN is specified using the number to be assigned as the VLAN ID, valid values range from 1 to 4094. If you specify a duplicate VLAN ID, no VLANs that you request in the command are created. You may assign a single team or adapter no more than 4 VLANs. You can assign more than 1 VLAN by including the optional 'number' parameter. The parameter specifies the total number of VLANs you wish to assign. Valid values range from 1 to 4094. If there are already VLANs assigned to a team, the maximum valid value of the number of VLANs to be assigned is reduced by the number of existing teams. If you specify an invalid value, the command is rejected without any other action being taken.

When you assign multiple VLANs, the specified VLAN ID is used as the VLAN ID of the first VLAN. That VLAN ID is then incremented to generate the VLAN ID for the next VLAN. This process applies to each additional VLAN being assigned. If any of the generated VLAN IDs are already in use, or are outside the range of valid values, the command is rejected without any other action being taken.

Parameters:

Team-id - If a VLAN is to be assigned to a team, this is the team name.

Adapter-id - If a VLAN is to be assigned to an adapter, this is the adapter alias.

VLAN-id - The number to be used as the VLAN tag. Valid values range from 1 to 4094.

Number - An optional parameter specifies the total number of VLANs to be assigned. Valid values range from 1 to 4. If there are already VLANs assigned to a team, then the maximum valid value of the number of VLANs to be assigned is reduced by the number of existing teams. If an invalid value is specified the command is rejected without any other action being taken.

Example:

```
C:\Program Files\Emulex\NIC Teaming>OCTeamCmd.exe add vlan mylbteam 3 4
VLAN 3 added to mylbteam
VLAN 4 added to mylbteam
VLAN 5 added to mylbteam
VLAN 6 added to mylbteam

C:\Program Files\Emulex\NIC Teaming>OCTeamCmd.exe add vlan nic6 100 2
VLAN 100 added to nic6
VLAN 101 added to nic6

C:\Program Files\Emulex\NIC Teaming>_
```

Deleting a VLAN

Note: Do not remove a team or VLAN while they are carrying traffic. If you do, unpredictable results will occur.

Syntax:

```
delete vlan <team-id|adapter-id> < < vlan-id> {number} | vlan alias>
```

Description: This command deletes one or more VLANs from a team or an adapter. Specify a VLAN with the VLAN ID. Optionally, you can delete multiple VLANs by following the VLAN ID with the number of VLANs to be deleted. If you are deleting multiple VLANs, the specified VLAN ID is used as the VLAN ID of the first VLAN to delete. The VLAN alias (i.e. VLAN_100) can replace the VLAN ID in this command. The VLAN IDs of the other VLANs to be deleted must sequentially follow the VLAN ID of the first VLAN. If any of these VLANs do not exist, then no VLANs specified in the command are deleted.

Single VLANs may also be deleted by specifying their VLAN alias or ID without the optional number of VLANs to delete.

Parameters:

Team-id - If a VLAN is to be assigned to a team, this is the team name to deleted.

Adapter-id - If a VLAN is to be assigned to an adapter, this is the adapter alias to be deleted.

VLAN-id - VLAN tag.

Number - An optional parameter specifies the total number of VLANs to be deleted. Valid values range from 1 to 4.

Example:

```
C:\Program Files\Emulex\NIC Teaming>OCTeamCmd.exe delete vlan mylbteam 3 4
VLAN 3 deleted from mylbteam
VLAN 4 deleted from mylbteam
VLAN 5 deleted from mylbteam
VLAN 6 deleted from mylbteam

C:\Program Files\Emulex\NIC Teaming>OCTeamCmd.exe delete vlan nic6 100 2
VLAN 100 deleted from nic6
VLAN 101 deleted from nic6

C:\Program Files\Emulex\NIC Teaming>OCTeamCmd.exe delete vlan nic5 3
VLAN 3 deleted from nic5

C:\Program Files\Emulex\NIC Teaming>_
```

APPENDIX A Load Balancing Use Cases

Perceived Port Load

This method automatically distributes TCP/IP traffic across team member channels by examining traffic load history patterns.

When to Use

Favorable types of traffic patterns for this balancing method include web traffic (HTTP, HTTPS) and e-mail traffic (SMTP, POP3). New TCP/IP connections are assigned to the more lightly loaded member channel links to balance traffic loading across all members over time. Only TCP/IP traffic is balanced and distributed (other non-connection oriented traffic, such as UDP/IP), and non-IP traffic (such as IPX/SPX and others) is assigned to a single default team member and is not balanced. Once a connection is opened and assigned to a member link, that TCP/IP connection's traffic is never moved to a new link without regard to the out-of-balance level the overall team might be experiencing. There must be a consistent stream of new TCP/IP connections (and typically a consistent stream of terminated TCP/IP connections which have finished work) for this traffic balancing method to perform well.This type of process works well for servers that process a lot of small transactional operations that start and then end individual TCP/IP connections for each transaction. Some database protocols involve new connections for each query and these also work well with this method.

When Not to Use

Connections that are very long lived or which are not TCP/IP based are a poor fit with this choice of balancing technique. Examples of long-lived connections are most TCP/IP storage traffic such as NFS (Unix/Linux, others), CIFS (Windows), and iSCSI (widespread usage).

Destination MAC

This method is team member channel selection (hashing) based on the destination MAC address.

When to Use

Use this method when the local system is the server and the server communicates through a NIC team to a switch, and then to many other systems on the local subnet (typically many client, laptop or desktop systems). To be effective, the remote systems must be located on the same IP address subnet as the server team is located. Use this method only when the server system communicates with many clients (or other servers) on the local subnet. Only systems that are on the local subnet have highly variant destination MAC addresses in Ethernet frames sent from the server system NIC team to those systems.

When Not to Use

If the client, laptop or desktop systems are located on different IP subnets and IP routing is required to reach them (from the server), this method is typically not a good fit. When the Ethernet frames sent from the server system's NIC team to the IP router (often a single gateway) all have the same constant destination MAC address (that of the IP router), this method does not distribute traffic well. When all of

the packets in all of the TCP/IP have the same destination MAC address (of the IP router), they all hash to the same member (individual link) of the NIC team, and all of the traffic has to travel on one link instead of being distributed to across many links.

Destination IP

This method is team member channel selection (hashing) based on the destination IP address.

When to Use

Use this method in these two situations:

- When a server communicates with many client systems (or peer servers) that are on the local IP subnet (they have the same subnet as the server). In this case, the Destination IP address varies for each client, and a good distribution of load based on varying IP addresses results between the server and the network switch.
- When the local server communicates with many client systems (or peer servers) that are located on different IP subnets. Non-local (different subnet) or local IP addresses give a good distribution with this method when the IP addresses have good variation across the group. IP address assignments are often not in the control of the administrator setting up a NIC team, therefore the best way to guarantee a good distribution is when the group of client systems is large, and there is good random variation in their IP address assignments.

When Not to Use

This method is a poor fit when you have communication between only a few clients (or peer servers) and the server, as there is insufficient variation in the set of destination IP addresses because there are few partners for IP traffic.